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RASPBERRY
CULTURE



THE RASPBERRY is grown not only in small plantations for the home and local market, but in some sections as the principal commercial crop. In these localities the raising of raspberries has become highly specialized, and methods of growing which are peculiar to this industry are employed.

This bulletin furnishes information as to the best methods of raising raspberries, and particularly considers practices which differ from those used with other bush fruits. Varieties are listed, characterizations of the leading sorts and their adaptations are made, and the autumn-fruiting sorts are discussed. The varieties liked best for canning and preserving are listed and directions for their utilization given.

The directions given are based on practices which have proved highly successful in different sections. They may require modification in some particulars to meet local conditions, but they will be of value to those whose experience in raspberry culture is limited.

RASPBERRY CULTURE

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TYPES OF RASPBERRIES

THREE types of raspberries (red, black, and purple) are grown extensively in the United States. Red raspberries bear red fruit, have erect canes, and usually are propagated by the suckers which come from the roots of the parent plant. Some of the varieties under cultivation come from the European and the rest from the American wild red raspberry or are hybrids of these two types. Among the leading red varieties are the Cuthbert, Ranere, and King.

Black raspberries, or blackcaps, bear black fruit, have arched canes which root at the tips in the autumn, and are propagated by the plants formed at the tips. All black varieties come from the American black raspberry, which grows wild in the eastern part of the United States. Under cultivation they are not, however, as hardy as some of the red varieties which come from the American wild-red raspberries. The Farmer and Cumberland are important commercial sorts of the black type.

The varieties under cultivation bearing purple-colored fruit are hybrids between the red and black raspberries and have canes that arch and root at the tips, as do the black raspberries. The Columbian and Cardinal are leading purple sorts.

Occasionally plants appear of both the red and black types which bear yellow fruit, but the yellow varieties in cultivation belong to the red-fruited type. The Golden Queen is the leading yellow-fruited variety. It is rarely grown for the general market, but is adapted to home gardens and to special markets.

Figures 1 and 2 show the differences between the fruit clusters of the red and black varieties.

EXTENT AND DISTRIBUTION OF RASPBERRY GROWING

In 1920, according to the reports of the Fourteenth Census, there were 50,278 acres of raspberries in the United States. Table 1 gives the distribution of raspberries in 1920, by States.

TABLE 1.—*Acreage devoted to raspberries in the United States in 1920, by States*

Geographic division and State	Acreage	Geographic division and State	Acreage
New England States:		South Atlantic States—Continued.	
Maine.....	311	West Virginia.....	1,208
New Hampshire.....	208	North Carolina.....	38
Vermont.....	246	South Carolina.....	14
Massachusetts.....	481	Georgia.....	26
Rhode Island.....	52	Florida.....	4
Connecticut.....	281	East South-Central States:	
Middle Atlantic States:		Kentucky.....	499
New York.....	10,344	Tennessee.....	307
New Jersey.....	1,621	Alabama.....	7
Pennsylvania.....	2,770	Mississippi.....	8
East North-Central States:		West South-Central States:	
Ohio.....	3,138	Arkansas.....	226
Indiana.....	1,988	Oklahoma.....	35
Illinois.....	2,298	Texas.....	7
Michigan.....	9,786	Mountain States:	
Wisconsin.....	1,619	Montana.....	102
West North-Central States:		Idaho.....	450
Minnesota.....	1,554	Wyoming.....	16
Iowa.....	2,213	Colorado.....	600
Missouri.....	1,689	New Mexico.....	14
North Dakota.....	111	Utah.....	383
South Dakota.....	70	Nevada.....	5
Nebraska.....	146	Pacific States:	
Kansas.....	991	Washington.....	1,786
South Atlantic States:		Oregon.....	1,176
Delaware.....	38	California.....	417
Maryland.....	586		
Virginia.....	427	United States.....	50,278
District of Columbia.....	2		

It should be noted that the cultivation of the raspberry is limited very largely to the northern part of the United States, chiefly to those sections in which the wild raspberries grow most abundantly.

The red-raspberry sections, from which extensive shipments are made, are located in southern New Jersey, in the Hudson River valley, in western New York, in western Michigan, in the Puyallup Valley of Washington, and about Sebastopol, Calif.

Black raspberries are grown for commercial shipment in western New York, in western Michigan, in the sections about Wathena, Kans., and Hagerstown, Md., and to a less extent in other places. There are few plantations in the Southern States or on the Pacific coast.

The purple varieties are grown extensively in western New York only, although for local market and home use their range is about the same as that of the blackcap.

LOCATION OF A PLANTATION

Particular attention should be given to the locality in which the raspberry plantation is to be established.

The hot summers of the South are not favorable to the production of this fruit, which is a native of States having a cool climate. There are few plantations south of Virginia, Tennessee, and Missouri, and even the warmer parts of Virginia and Tennessee are not well adapted to raspberry growing. The black and purple varieties have not proved to be well adapted to conditions in the Pacific Coast

States, although red raspberries are grown very successfully in that part of the country. In most of the Great Plains area and in parts of the Mountain States of the West the winters are too severe or the summers too hot and dry for raspberry growing.

The raspberry plantation should be located near a good market or good shipping point if it is to be most profitable. The roads to that market or shipping point should be such that the berries will not be injured when hauled over them. If the fruit is to be shipped long distances it is essential that quick transportation and refrigerator-car service be available.

SITE OF A PLANTATION

Three important factors which should be considered in the selection of a site are the soil type, the moisture supply, and the air drainage.

Although the raspberry will succeed on a wide range of soil types provided suitable moisture conditions prevail, the best results will be secured only by studying the peculiar requirements of the different varieties. A fine, deep, sandy loam is perhaps the most desirable soil for growing raspberries, because it is managed so easily. Equally good yields of some varieties will be secured

on clay and on sandy soils if they are well managed. In general, however, though the black raspberries seem to do best on sandy soils, they are grown extensively and succeed well on clay soils. Among the red raspberries the *Ranere* does best on sandy types, but the *June* prefers a clay soil. Other varieties, such as the *Cuthbert* and *King*, succeed on a wide range of soil types. Where the soil requirements of varieties are known, they are indicated in the characterizations given on later pages of this bulletin.

The most important, perhaps, of all the factors entering into the growing of raspberries is the moisture supply, and where there is the possibility of a choice, the soil which will furnish an ample supply of moisture at all times should be chosen. At no time, how-



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Fig. 1.—A fruit cluster of the *Loudon* (red) raspberry

ever, should there be wet places in the plantation. Thorough drainage as well as a full supply of moisture is essential.

Another important factor is air drainage. Cold air settles to the lower levels, and plantations situated on land elevated above the surrounding fields will not be as subject to the extreme cold of

winter as plantations on the lower levels. Winter injury to the canes may often be avoided by choosing a site higher than the surrounding country. Furthermore, plantations on the higher elevations are not as subject to frost injury in late spring as those not so favorably located.

In the Southern States, a fourth factor in the selection of a site is of some importance. If raspberries are to be grown in those States, a northern or northeastern slope is preferred for the plantation, as humus and moisture are retained better in fields on such slopes than on southern slopes.

For home gardens, the chicken yard is frequently a desirable place for the raspberry patch. Poultry keep down weeds and enrich the soil, and do not often injure the berries.



FIG. 2.—A fruit cluster of the Cumberland (black) raspberry. Contrast the stiff, prickly fruit stems here shown with the slender, drooping stems of the red variety shown in Figure 1

PREPARING THE LAND

The same thorough preparation of the soil should be given for a raspberry plantation as for corn or similar crops. For the best results the plants should never be set in a field which has just been in sod, but should follow some hoed crop. Land which produced a

crop of potatoes the previous year and which has later been plowed and thoroughly pulverized is in the best physical condition for setting the plants, and any field on which crops have been grown which leave the soil in a similar condition is prepared properly for raspberries.

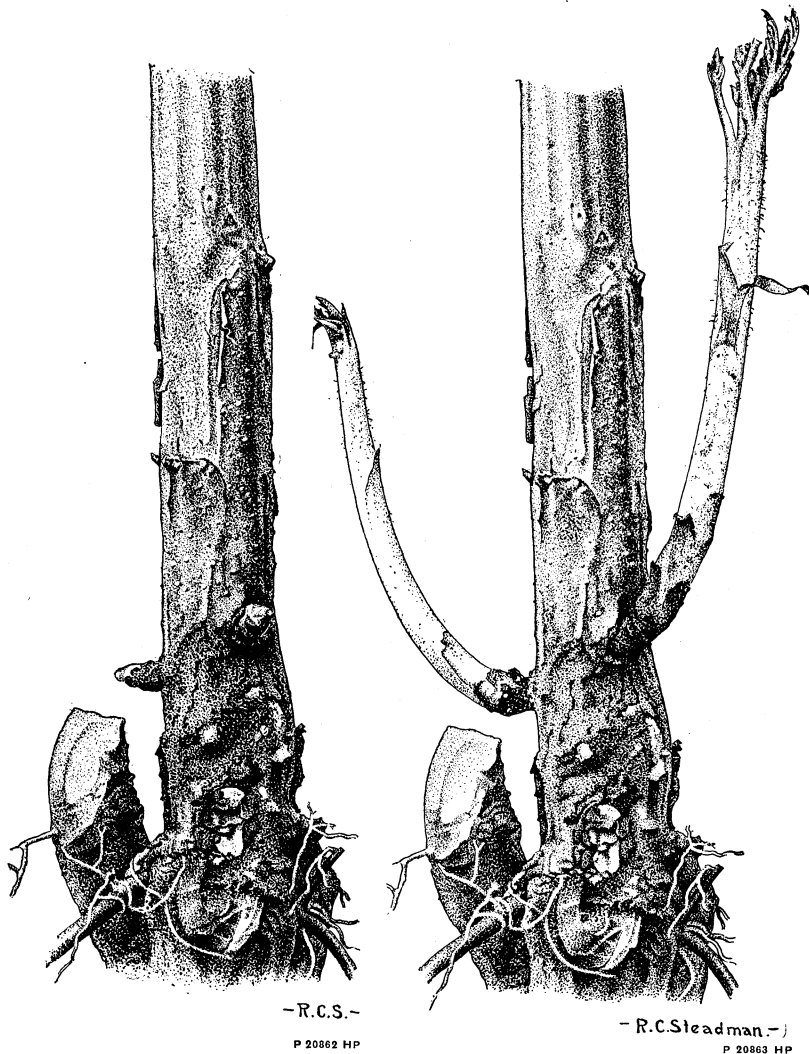


FIG. 3.—Lower part of a raspberry cane, showing dormant leader buds from which strong, vigorous shoots will grow in the early summer. (Drawing from a photograph taken February 9)

FIG. 4.—Lower part of the raspberry cane illustrated in Figure 3, showing the new canes that have started growth from the leader buds. (Drawing from a photograph taken March 7)

PLANTING

The time of planting raspberries varies in different parts of the United States, according to the local conditions. In general, however, the plants should be set in early spring in the eastern part of

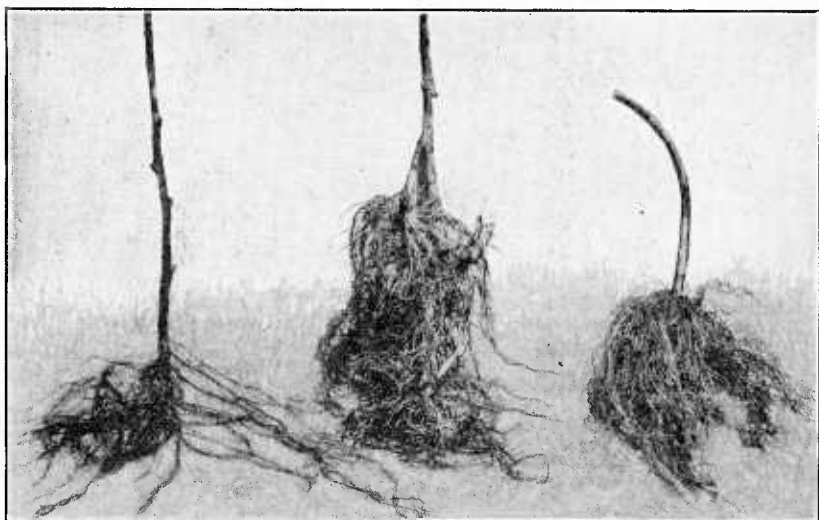
the United States, but on the Pacific coast they should be set during the rainy season, whenever it is possible to do the work.

Because better plants of the black and purple varieties can be secured in the spring, that is the best season for setting them. Red raspberries, however, may be set in the autumn with good success in sections where the winters are mild or where there is a good covering of snow to protect the plants. Some of the advantages of autumn planting in sections where this is possible are the following:

(1) There is usually a much longer season in which the planting conditions are favorable than in the spring.

(2) During the winter the plants become thoroughly established in the soil, and they start growth quickly in the spring.

(3) In the autumn the leader buds from which the new canes develop are dormant and are not broken easily. By spring, however, they have grown to a considerable length, often several inches, and then are broken very easily in planting. Unless the root is vigorous, such plants may not develop new shoots.



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FIG. 5.—Sample raspberry plants good for setting: Ranere (red) at the left, Columbian (purple) in the center, and Cumberland (black) at the right

Figure 3 shows the leader buds at the base of the cane in a dormant condition, and Figure 4 shows the buds after they have developed into shoots several inches long, which are broken very easily.

Occasionally when growers wish to set a new plantation they wait a month after growth starts in the spring and use the suckers that come up during that month in their established plantation. If the season is favorable, this practice may prove satisfactory. If, however, a drought occurs soon after, the young plants will suffer severely. Only in sections where the climate is favorable is this practice to be recommended.

SECURING AND HANDLING NURSERY STOCK

Good nursery plants of the different types of raspberries are shown in Figure 5. It must be remembered, however, that the root systems of nursery plants of the different varieties vary greatly, and what

constitutes a good nursery plant of one variety may be a poor plant of another variety. Thus the Royal, a purple variety, rarely makes as large a nursery plant as does the Columbian, shown in Figure 5. Consequently a good nursery plant of the Royal would not be considered a good plant of the Columbian.

It is possible to secure a good crop of berries from plants the year after they are set and a full crop the second year after planting. To do this, only the best grade of nursery stock should be ordered. If the plants are to be propagated at home, only the strongest tip plants of the black and purple sorts and the strongest suckers of red



FIG. 6.—A bundle of 27 good plants of the Ranere raspberry as received from the nursery. When such plants can not be set immediately, they should be "heeled in"

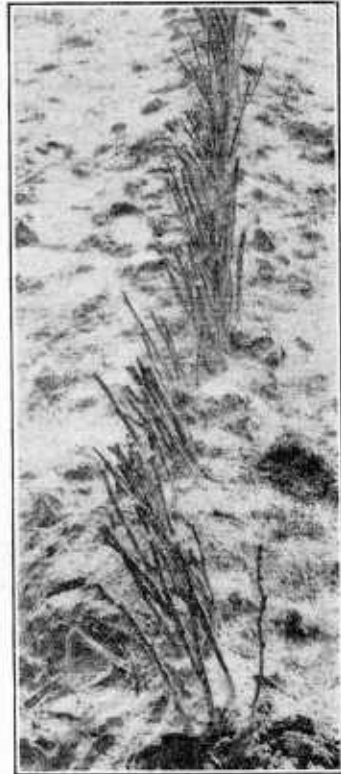


FIG. 7.—Plants of the Cuthbert raspberry as received from the nursery, "heeled in" awaiting favorable opportunity to plant

varieties should be selected. The average production of raspberries per acre, according to the last census, was less than 1,000 quarts. It is possible by selecting the best tip plants, planting them in fertile soil, and giving them good care to secure more than 3,000 quarts per acre the year after setting and more than 6,000 quarts the following year from black raspberries.

Figure 6 shows a bundle of plants of the red raspberry as it was received from the nursery. In case the plants are not to be set immediately, they should be heeled in; that is, a trench should be dug and the roots placed in it and covered with moist soil. In order to work the soil thoroughly about the roots of each plant it will be necessary

to open the bundles and spread the plants along the trench, as shown in Figure 7. Sometimes it is desirable to wet the roots, or, if they are very dry, to soak them for a few hours before heeling in the plants. Just before setting it is well to dip the roots of the plants in a puddle made of clay and water or cow manure and water. The roots are thereby partially protected from the wind and sun.

Plants affected with crown-gall should not be set. Moreover, many plants coming from fields in which the disease occurs may be



FIG. 8.—Perfection red raspberries 1 year old, planted in accordance with the hill system. (Photographed at Milton, N. Y., June 18, 1915)

affected but not show it, so that if only a few plants show galls when planted, many may appear later. This disease can be recognized by the knots and swellings which appear on the roots and about the crown. Such diseased plants are very much less productive than healthy stock and are especially subject to winter injury.

SYSTEMS OF CULTURE

Three systems of culture are used in growing raspberries, the hill, the linear, and the hedge systems. The term "hill system" is restricted to that method of tillage in which the horse cultivator is used on all sides of each plant. When the cultivator is run in only one direction and only the plants originally set are allowed to fruit, the term "linear system" is used. If some of the suckers which come from the roots of red raspberries are left to form a solid row and the cultivator is run in one direction only, the term "hedge system" is employed.

The distance between the rows in each of these systems should be determined by economy in the cost of cultivation and in the use of land. Where the area of land available for planting is not limited, usually it will be found most desirable to make the spaces between

the rows wide enough to allow the use of 2-horse implements in cultivation. Where the area of land is limited, the rows may be placed closer together and 1-horse implements used.

PLANTING DISTANCES

Under the hill system of culture the plants usually are set about 5 feet apart each way. This, however, allows the use of 1-horse

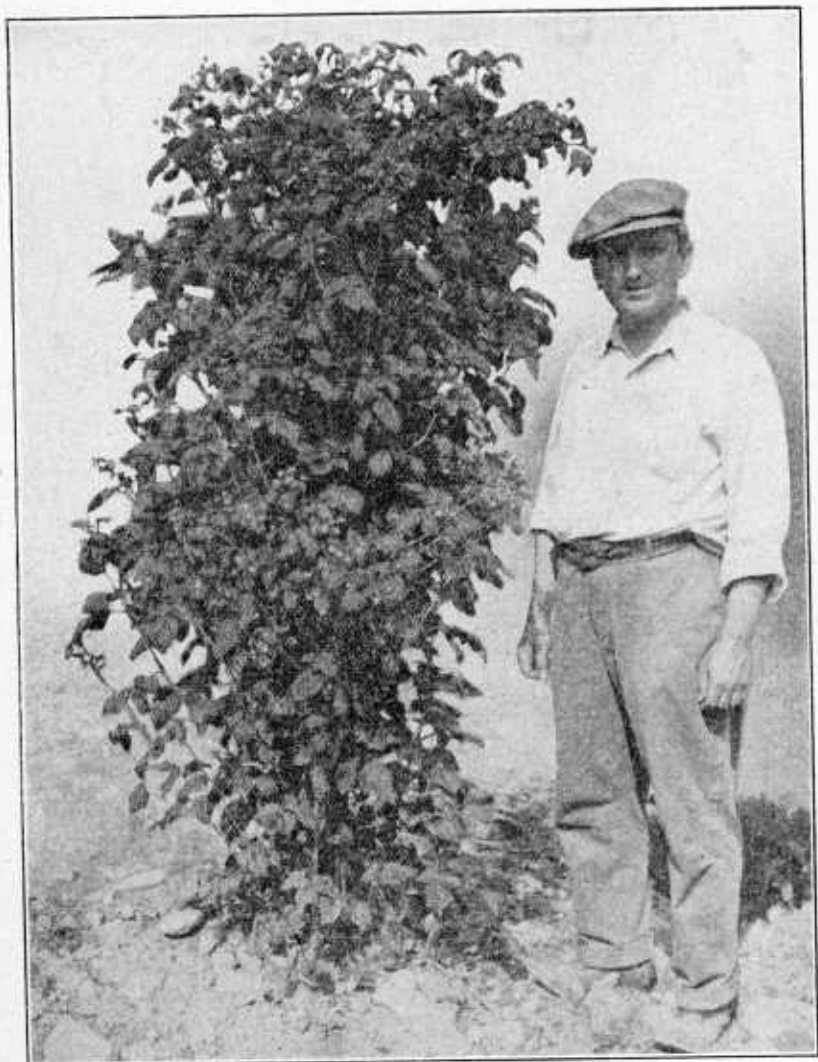


FIG. 9.—A perfection red raspberry planted in accordance with the hill system. This plant has seven bearing canes, which are tied to a single stake. (Photographed at Milton, N. Y., June 18, 1915)

cultivators only. Figures 8 and 9 show fields planted according to the hill system. This is used to some extent in New York and other States in raising red raspberries. It has the advantage of requiring less handwork in keeping out grass and weeds, as the cultivator can be run in both directions; and the berries can be more easily harvested from fields under this system.

If the hedge or linear system is used, the horse cultivator can be run in one direction only and more hand hoeing is necessary. Under these systems the red varieties usually should be set from $1\frac{1}{2}$ to 3 feet apart in rows which are 6 to 8 feet distant. In the eastern United States 6 feet is the most common and desirable distance between the rows for the shorter caned varieties, such as the Ruby and Marlboro, and 7 and 8 feet for the tall-caned varieties, like the Cuthbert. To use two horses in a plantation the rows must be at least 8 feet apart. In the Pacific Northwest, where the canes grow very tall, the planting distance for red raspberries is usually $2\frac{1}{2}$ by 7 or 8 feet. In parts of Colorado and other States where irrigation and winter protection are necessary, the plants are usually set in rows which are 7 feet apart.

Black raspberries are nearly always grown under the linear system, and in the United States east of the Rocky Mountains they



FIG. 10.—Setting raspberries. The shovel or spade is thrust into the soil and forced forward. The plant is put in the opening thus made and the shovel is then withdrawn. Earth is later firmed about the roots, as shown in Figure 11. (Photographed at Putney, Vt., April 23)



FIG. 11.—Firming the earth about the roots of the raspberry plant shown in Figure 10. In this field not more than 2 or 3 out of the 10,000 plants set failed to grow. Figures 10 and 11 illustrate a common and inexpensive method of setting raspberry plants

should be planted in rows 8 feet distant and 3 or 4 feet apart in the row. In Oregon and Washington they should be planted in rows 7 or 8 feet distant and from 3 to 6 feet apart in the row, depending upon the vigor of the growth in the particular locality.

The purple varieties also are grown under the linear system and should be planted 4 or 5 feet apart in rows which are 7 or 8 feet distant. The Columbian and other purple varieties of equal vigor should be at least 5 feet apart in the row, but the Royal may be set 4 feet apart.

If the plants are checked in both directions when set in accordance with either the hedge or linear system and are 3 or 4 feet apart in the row, it is possible to run a 1-horse cultivator both ways for the first year. This will save much work and reduce the first year's expense.

In some sections, two plants of red raspberries are set together. This insures the grower against misses, and a larger crop is secured when the plantation is 1 year old. It will cost nearly \$20 more per acre to buy and set the extra plants, but in some sections the additional yield will make it profitable. However, if care is taken in setting, one plant in each place is usually sufficient.

SETTING THE PLANTS

Before planting, the tops of the plants of all types should be cut back to 6 inches or less in height. To make it easy to handle the plants and to indicate the rows after setting, 4 to 6 inches of the cane are often left. However, to help control the anthracnose disease on black and purple sorts it is recommended that all the cane be removed or entirely buried when the plants are set. By this means anthracnose can be eliminated at the planting season. If a garden patch is being planted, it is better to cut the canes back to within a few inches of the leader buds. The plants should be set slightly deeper than they formerly grew. Sometimes it is well to set red raspberries as much as 3 inches deeper than they grew, in order to protect them from drought. Black and purple raspberry plants should be set not more than an inch or two deeper than they formerly stood, as there is danger of smothering the tips.

Figures 10 and 11 illustrate a common and inexpensive method of setting the plants. The rows have been marked out previously and plants have been dropped every 3 feet along the row. The spade is thrust into the ground, the handle pushed forward, and the root placed in the space thus opened, as shown in Figure 10. The spade is next withdrawn and the earth firmed about the roots, as shown in Figure 11. Plants should not be dropped much ahead of those who are setting them, however, as exposure to the sun and wind weakens the roots.

MOISTURE SUPPLY IN THE SOIL

From the time raspberry plants are set, they need an ample supply of moisture, and they are affected more quickly and seriously when it is deficient than most other fruit plants. In the sections where the highest average yields of red raspberries are obtained, often 6,000 quarts of fruit per acre are secured. The average for the whole country, however, is less than 1,000 quarts, and much of this difference is due to a difference in the moisture supply. In the sections referred to as giving the highest yields, a deep soil furnishes a uniform and ample supply of moisture at all times. To secure the best results, therefore, the grower should, by tillage and by supplying humus, maintain a uniform and ample moisture content in his soil, not only during the growing and ripening of the fruit but also while the canes are developing. Some growers make it a regular practice each year to mulch their fields to a depth of several inches with straw, leaves, or green hay. When this practice is followed, the cost is great, but the moisture supply is retained well.

In semiarid and arid regions where irrigation is practiced, the fruiting season is longer than in most humid or nonirrigated sections. The use of irrigation in the Eastern States also has extended the picking season and made the plants thriftier. Larger yields of fruit of the *Ranere* raspberry in the summer and fall have followed

the irrigation of that variety and made it profitable in some sections of the East.

In the semiarid and arid regions of the Pacific coast, irrigation should begin almost as soon after the rainy season as is necessary for garden crops and should be continued at least until after the picking season is over. The frequency of irrigation will depend upon the local climate, the soil type, and the management of the soil. In southern California the plantations should be irrigated as often as every week during the fruiting season, and about once in two or three weeks during the rest of the dry season. A cultivator should be run between the rows after each application of water. When this is done the irrigation need not be so frequent, and the soil will be kept in better condition than without such tillage. Under such treatment the Surprise red raspberry will produce not only a good second crop of fruit during the late summer or early fall in some parts of California but also some fruit almost continuously from the first picking in the spring until late autumn. In arid and semiarid sections other than California such frequent irrigation is not often used; its frequency is determined by local conditions.

In the humid sections of the Eastern States irrigation should be used chiefly or entirely during the growth and ripening of the fruit and will pay only when an ample moisture supply can not be maintained by tillage. As the raspberry ripens its crop during the summer when droughts are likely to occur, some growers have found irrigation profitable.

INTERCROPPING

In order to reduce the cost of intensive cultivation of a raspberry plantation during the first year after setting, other crops that need cultivation during the spring and early summer months may be grown between the rows. Among the crops best suited to this use are the tomato, cabbage, cauliflower, bean, pea, summer squash, and potato. Grain crops should not be used, as they are not cultivated and will take moisture and plant food needed by the raspberry plants. The second season no other crops should be grown, as the raspberry roots should occupy all the ground.

TILLAGE

Tillage in raspberry fields must be thorough and more regular than for most other crops. If grass and weeds get a start, it is very difficult to clean the rows. Not only will it prove costly to clean them, but grass and weeds take the needed moisture and interfere with the development of new canes. If grass is allowed to make a sod in a field trained to the wide hedge system, it is usually cheaper to set out a new field than to clean out the sod.

Tillage should be thorough and regular in order to conserve moisture. Except in rainy weather, a cultivator or harrow should be used at least once each week up to picking time. Some growers consider it profitable to use it as often as twice each week, and this is sometimes necessary during periods of extended drought. The cultivation should stir the soil to a depth of 2 to 3 inches only, as part of the raspberry roots are shallow. Many growers shorten the cultivator or harrow teeth which run next to the plants, so as to disturb the young feeding roots near the surface as little as possible.

During the harvesting season the berries need an additional supply of moisture, and ordinarily the cultivation should be continued. Many growers cultivate after each picking, loosening the soil packed down by the pickers. If too much dust is carried to the fruit it may be necessary to cultivate only occasionally during the picking season. Also if no trellis or stakes are used and if the canes bend over under a crop of fruit it will be impossible to use a cultivator without knocking off too much fruit.

Later tillage is for the purpose of keeping down weeds and grasses. The fields should be free of weeds during the winter season, as many kinds start quickly in the spring and are difficult to destroy after the soil is in condition to work. Autumn tillage, however, tends to develop new growth, which is tender and somewhat more subject to winter injury than the older growth. Autumn tillage, therefore, should be avoided as much as possible where there is danger from severe winters.

MAINTENANCE OF FERTILITY

The use of fertilizers in raspberry plantations is governed by the same principles that apply to their use with other fruits. As soils vary in the quantity and availability of the plant food they contain, the fertilizer problem is a local one which each grower must solve for himself. By using varying amounts of the different elements of plant food on different plats and keeping a record of the yields, each grower can determine readily what kinds and quantities of fertilizer to apply.

Good management, however, will insure a large amount of humus in the soil at all times. It is especially desirable that the humus supply be ample when the plantation is first set out. It is much easier and cheaper to furnish the humus by means of cover crops and stable manure before the plantation is set than afterwards when the plants are growing. Moreover, by such extra care before setting it is possible to secure a fair crop of fruit the second season. Because it costs so much to care for a plantation for a year it will pay well to have the soil in a high state of fertility before the plants are set, so that the plantation may be brought into bearing a year sooner than would be possible otherwise.

A distinction as to their fertility requirements should be made between the red and black varieties. Apparently, no soil is too fertile for satisfactory results with the black raspberry, and the richer the soil the stronger the growth and the greater the crop. The red raspberry should be grown on a fertile soil, but the relation of fertilizers to crop production in red varieties is not well understood. The best results may not come from using as heavy applications of fertilizer as for the black raspberry. Purple varieties seem to respond somewhat as do the black raspberries.

In many sections no fertilizers are used on bearing plantations. In the older raspberry section, however, some commercial fertilizer and stable manure are used, and it is considered profitable to use them. Stable manure, however, usually has given the best results and experiments have shown that, where obtainable, it furnishes the best means of enriching the soils on which the experiments have been tried. Stable manure not only furnishes some plant food but supplies large quantities of humus. If an annual application of about 10 tons per acre is made, the humus supply should be maintained, and

with proper treatment in other ways the field should be kept at a high state of productiveness. Some soils and some sections will need a larger quantity and some less than 10 tons per acre. A heavier application, however, should not be made unless it has been found by actual trial to be desirable, as it is possible to stimulate the growth of canes and leaves to such an extent as to reduce productiveness.

An application of about 200 pounds of nitrate of soda per acre to black-raspberry fields at blossoming time is suggested, if stable manure is not available.

Cover crops may be used to maintain the humus supply. Oats seeded at the rate of 3 bushels per acre in the late summer should give a dense stand of material to turn under before winter, or they may be left to serve as a covering during the winter and plowed under in the spring. Cowpeas, vetch, the various clovers, and other crops also may be used in the raspberry plantation. Care must be taken in growing the vetch and clovers, as they live through the winter and it may prove costly to eradicate them. However, if they are drilled in between the rows and turned under before they become too rank in the spring, little trouble should be experienced.

SYSTEMS OF TRAINING AND PRUNING

The best system of training and pruning the different types of raspberries depends largely upon their manner of growth. All types send up shoots called "turions" from the leader buds which usually are formed at the base of the old canes, as shown in Figures 3 and 4.

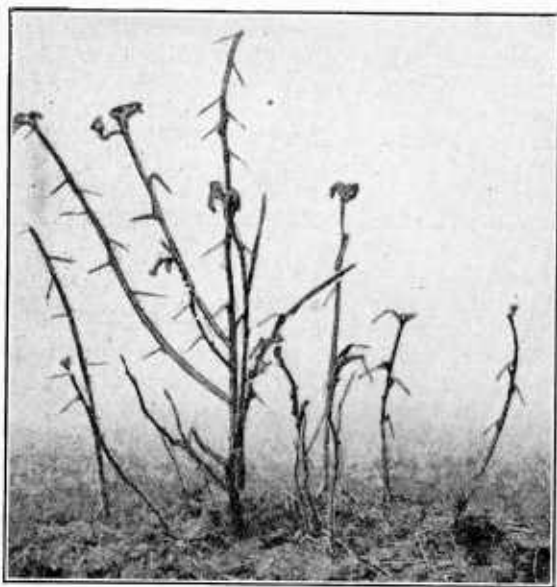


FIG. 12.—A Ruby red raspberry plant having two strong canes which grew from leader buds and with a large number of suckers springing from the roots

Sometimes only one such bud is produced on each cane, but usually at least two are formed, and sometimes three or more appear. Thus, if two canes grew the first year after planting and each produced two buds, four canes would appear the second year, eight canes would be formed the third year, and by the fourth year there would be 16. However, some of the buds do not start and many of those that do start make weak canes, so that when plants are in bearing about the same number of

strong canes are produced the first year after the plantation comes into full bearing as during each of the following years.

The new shoots of all types of raspberries complete their development in size the first season. The second season small side branches

are sent out on which the fruit is borne. As soon as the berries ripen the cane dies and is cut out. Thus the canes are biennial, that is, they live for part of two years; and the roots are perennial, living for many years. A few varieties of red raspberries, among which is the *Ranere*, bear fruit on the tips of the new canes in the summer and autumn of their first year of growth. Such tips die back, and the parts of the cane which have not fruited bear the following summer.

In addition to producing canes from the leader buds, red raspberries send up shoots called "suckers" from their roots (fig. 12), but the black and purple varieties do not send up suckers. Some varieties of red raspberries produce suckers in large numbers; others produce few. Deep plowing or cultivating may cut the roots of the red raspberry and cause an increase in the production of suckers. Therefore, if some system of training were not used a red raspberry field would soon become a dense thicket of canes, each competing with others for food, moisture, and light, and the berries could be picked only with difficulty. Because of this the methods of pruning and training of red raspberries differ from those employed with the black and purple types and are described separately.

The system of training and pruning varies not only with the type of raspberry, but also with the vigor and nature of the variety, with climatic conditions, with the cost of materials, and with the preference of the grower. Thus, the *Ranere* red raspberry makes a dense growth of comparatively slender canes, while others, like the *Marlboro* and *Ruby*, make fewer canes, which are much stouter and more erect. The *Ranere* is not a tall-growing variety, but the *Cuthbert* canes grow very tall. Varieties of the black and purple types do not show such great differences in growth as the red sorts. Nevertheless, the training and pruning system to be used with these types also will depend to a large extent upon the habit of the variety.

Under the conditions which are found in New England, canes of the *Marlboro* red raspberry usually grow from 3 to 5 feet high, yet in Washington and Oregon they may grow to a height of 10 to 14 feet. Similar differences occur when other varieties are grown in such sections and make it necessary to use training and pruning systems especially adapted to local conditions.

Reference to the figures illustrating the principal methods will indicate how different is the growth of plants in different sections and how numerous are the systems of training. Many variations and modifications of each of these are used, but only the principal ones will be described.

Three methods of culture of red raspberries are in use—the hill, the linear, and the hedge systems. As the planting plan of each is different, the system to be used must be determined before the plantation is set.

TRAINING RED RASPBERRIES UNDER THE HILL SYSTEM OF CULTURE

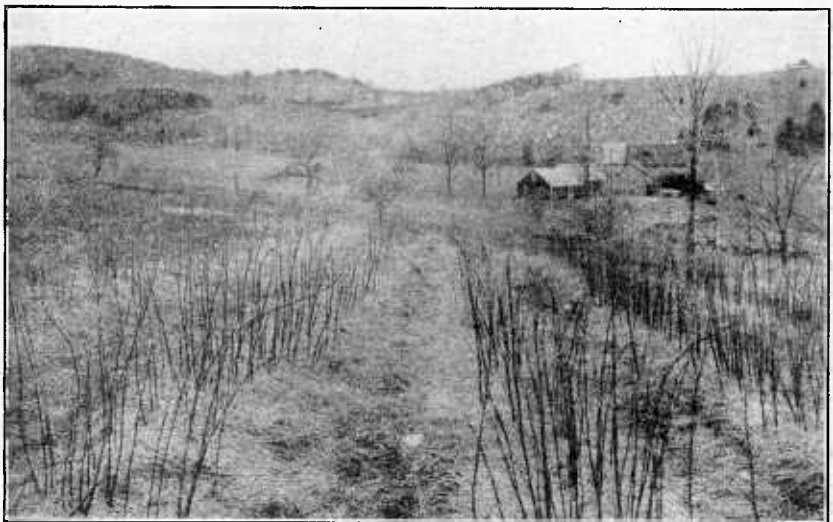
Under the hill system, the plants should be set about 5 feet apart each way. A stake 2 to 4 inches in diameter should be driven into the ground beside each plant when it is 1 year old and the canes tied twice to each stake, once about half way up and again at the top of the stake. Five to seven canes should be left to each plant, the others being cut out. Ordinarily no pruning back of the tips is needed. Figures 8 and 9 show fields of the *Perfection* raspberry grown under this system. The canes of this variety grow fairly tall and the stakes

in this case are about 6 feet above ground. Other varieties have shorter canes and the stakes should correspond to their height. Varieties like the Marlboro, Ruby, and Perfection may be grown under this system easier than those which make a rank growth of suckers, as does the Ranere.

This system is used in New York State very extensively and is to be recommended for sections having similar conditions. To secure the advantage of this system, however, it should be possible to cultivate in both directions with comparative ease, and it should be possible also to secure stakes at a reasonable cost.

TRAINING RED RASPBERRIES UNDER THE HEDGE SYSTEM OF CULTURE

Where the canes are stout and from 3 to 5 feet tall, growers often allow a solid row or hedge 2 to 3 feet wide to form, as shown in Figure



P 1335 HP

FIG. 13.—Ruby red raspberries at Putney, Vt., planted in accordance with the hedge system and mulched with straw. The rows are too wide for the best results

13. This system is very common over all the eastern United States and is adapted to such short-caned varieties as the King, Marlboro, Herbert, and Ruby. A modification of this system is used extensively in New Jersey in growing the Ranere. The canes of the Ranere are comparatively slender, and in early spring growers cut the tops back with hedge shears so that they can support the crop in an erect position. Sometimes the Cuthbert also is grown under this system, as shown in Figure 14.

The hedge system is modified further in some sections where the canes grow taller or are not stout enough to hold the fruit in an erect position. Under such conditions a "horizontal trellis" is made when the plantation is 1 year old by stringing two wires along each end of crosspieces which are attached to posts set every 15 to 30 feet in the rows. The wires support the canes, so that they are not broken by pickers or by those doing the cultivating. No pruning back is

done. This system is used somewhat in New York, in California, and in other States. A slight modification of it is used in the irrigated sections of eastern Colorado, where the canes are buried in the winter for protection against the cold. In this region posts are set only at the ends of the rows, as illustrated in Figure 15. The wires, which hold the canes erect, are held in place by wooden supports, as shown in Figure 16. These supports hold the wires about 2 feet high and $1\frac{1}{2}$ feet apart and can be taken down at any time, so that the wires will drop to the ground and thus be out of the way.

This system, called the wide hedge system, has serious disadvantages. When the row is from 2 to 3 feet wide it is difficult to get the



P 16857 HP

FIG. 14.—A field of Cuthbert red raspberries planted in accordance with the hedge system. The canes are pruned back in the spring, so that they will support the crop of fruit. (Photographed at Webster, N. Y., July, 1915)

berries picked; there always are some weak canes which bend over so that the fruit becomes dirty; there is such competition between the canes for moisture and light that the fruit is smaller than it otherwise would be; and unless the rows are more than 8 feet distant a 2-horse cultivator can not be used. Perhaps the most serious disadvantage of this system is that it is very difficult and expensive to keep such fields free from grass and weeds. If a sod is once formed, it is often cheaper to set a new plantation than to clean out the old one.

The best form of the hedge system for most sections is that called the narrow hedge system, illustrated in Figure 17. Suckers are allowed to grow up only in the rows between the plants originally

set, and all others are kept out. The rows then will be about 12 inches wide, and a large part of the tillage can be done with a cultivator. Wire trellises are used with this, as with the wide hedge system, when the canes are very tall or very weak. No pruning back in the spring should be done.

For much of the country this narrow hedge system is one of the most desirable systems and should be adopted by growers in place of the wide hedge system unless the hill or linear systems can be used.

TRAINING RED RASPBERRIES UNDER THE LINEAR SYSTEM OF CULTURE

The linear system, which differs from the hedge system in that no suckers are allowed to grow, seems to be becoming more popular and is to be preferred to any other in some sections. It is coming to



20455 HP

FIG. 15.—A field of Marlboro red raspberries planted in accordance with the hedge system of culture. The canes are held erect by a 2-wire horizontal trellis. Note the irrigation ditches (Photographed at Loveland, Colo., July 22, 1916)

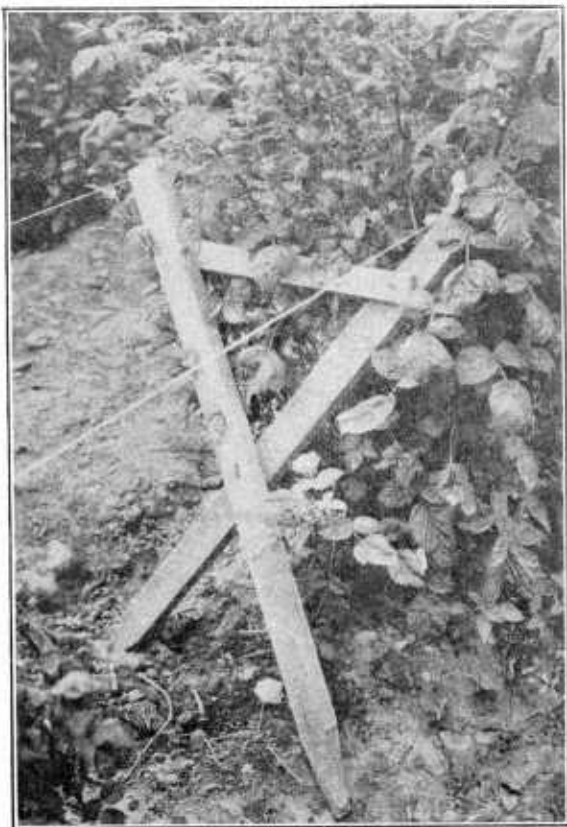
be used very commonly in training raspberries in all parts of the United States where varieties are grown which have strong erect canes, and it is the only system used to any extent in the State of Washington. The simplest form of this system is that used where the canes are stout and short and will hold an erect position when bearing a full crop of fruit. All sucker plants should be removed and the plants originally set kept for fruit bearing. Most of the cultivating can be done with the horse cultivator, and comparatively little handwork is necessary. Many prune back the tall-caned varieties in the spring and grow them by this system.

Where tall-caned varieties are grown and where the canes of many of the common varieties are very tall, various modifications of the

linear system are used. The canes may be held erect by a horizontal 2-wire trellis, such as is used in the hedge system. Two wires, one on each side of the row, hold the canes erect and are placed between 3 and 4½ feet above the ground. Sometimes when the canes are very tall they are pruned back to a height of 5 or 5½ feet and then held erect by a 2-wire trellis, as shown in Figure 18. Sometimes, to make picking more convenient, the canes are tied to the wires on either side and the new canes are allowed to grow up between the wires, as illustrated in Figure 9. Thus the fruiting canes are separated from the new ones.

Some growers use another form of wire trellis, where all the fruiting canes are tied to a single wire, as in Figure 20; or, when very tall, to two wires, one above the other, to hold them erect. The tying is cheap and is done easily by children. Figure 21 shows a simple method of tying where each cane is tied separately. A hard knot should be made every few feet, so that if the string breaks the damage may not be extensive. Where some provision is needed to keep the new canes out of the way of pickers and cultivators, an additional wire is strung along just before picking. This system of training to a wire trellis is in common use in most raspberry sections.

Where the canes of the Cuthbert variety grow to the height that they do in the Puyallup Valley in Washington, the growers use some system of training that will bring the fruit within reach of the pickers, and that will confine the canes and keep them out of the way in cultivating and picking. Sometimes the canes are topped, as shown in Figure 18. Sometimes, however, the canes are arched over the upper wire of a 2-wire trellis and tied to the lower wire or



P 20454 HP

FIG. 16.—A wooden support used in raspberry fields where two wires hold the bearing and young canes upright. A bent nail keeps the wires from slipping below the desired height

to the canes of the next hill, as in Figure 22. A cheaper and very satisfactory system is to arch the canes over a single wire, catch them under the canes of the next hill, and weave the ends along the wire and among the canes, as in Figure 23. In order to distribute the fruiting space more uniformly, it is better to weave each cane separately than to have all the canes of a hill woven together. As the berries borne on the ends of each cane ripen first, fields trained by these weaving systems produce the earliest fruit. In order to make picking easier, the posts and wires may be placed a foot to one side of the row. If the rows run east and west the trellis should be a foot to the south of the row. The fruiting canes then lean to the south and the young canes will grow up separated from them. Pickers and the carriers of berries will then be shaded by the young canes of



P 20451 HP

FIG. 17.—Red raspberries planted in accordance with the narrow hedge system of culture. The canes are kept in a row about 12 inches wide and are well spaced in the row. (Photographed at Excelsior, Minn., September 26, 1916)

the adjoining row. Such young canes are held erect by one or two wires on the north side of each row, which are strung along the ends of crosspieces at a suitable distance from the fruiting canes.

Many modifications of these systems are in use and are adapted to particular conditions. The linear system, where only the original plants are kept for fruiting, or the narrow hedge system, where the original plants and a very few suckers well distributed between them are retained, are generally the best. The life of the plantation under these systems is much longer, it is easier to conserve moisture in times of drought, and the picking is easier than in plantations trained to the wide hedge system.

The hill system is adapted only to localities where varieties which produce comparatively few canes are raised, where stakes are cheap, and where cultivators can be run easily in both directions

No pruning back of red raspberries should be done under any system if it can be avoided, as the removal of the ends usually lessens the crop and makes it somewhat later.

TRAINING AND PRUNING BLACK AND PURPLE RASPBERRIES

Nearly always the black raspberries and the purple raspberries now under cultivation are planted on the linear system, and as they do not send up suckers from their roots, their training is much simpler than that of the red raspberry. The young canes should be topped, in order to make them able to stand erect when bearing



FIG. 18.—A field of Cuthbert raspberries under the linear system of culture. Two wires, one on either side, hold the canes erect. The wires are about 4 feet above ground and the canes topped about 6 feet from the ground. (Photographed at Puyallup, Wash., February, 1915)

a heavy crop of fruit. Black raspberries should be topped at a height of 12 to 30 inches, depending on their vigor, 18 inches being the most common height. Purple raspberries should be topped at a height of 30 to 36 inches, as their growth is more vigorous. The topping may consist in cutting off the ends of the canes after all have reached the desired height, and usually it is done just before picking.

Topping also may be done by pinching off with the fingers the ends of the young canes as soon as they reach the proper height. In this case it will be necessary to go over the plantation several times, as the new canes do not all reach this height at the same time. Generally it will be much better to pinch off the ends rather than to cut them back.

Side branches called laterals will grow from the buds along the cane which has been pinched or pruned back. These laterals will grow to a length of several feet by late summer. In early spring, before growth starts, they should be shortened according to the vigor of the plant and the habit of the variety. The fruit is borne on the growth of the current season which starts from the well-developed buds on the laterals, and the number and size of the berries can be controlled by the number of buds left on them in the pruning. Varieties differ in the location of the buds and should be pruned accordingly. Sometimes the buds start very near the base of the



FIG. 19.—A field of Cuthbert raspberries planted on the linear system of culture. The fruiting canes are tied to wires on either side or held in place by extra outside wires, and the young canes grow up between the fruiting canes. Topping may be practiced if desired. (Photographed at Puyallup Wash., February 18, 1915)

lateral next to the main stem and sometimes at a distance from the base. The laterals in the former case should be pruned shorter than where the buds are borne at a distance from the base.

Recent investigations in Michigan show that where the canes are small the laterals should have not more than two buds each, while the largest canes can carry as many as six buds to each lateral. If more buds are left on each lateral, more berries will mature, but they will be smaller and of poorer market grade than if only two to six buds had been left. Moreover, the total crop from those with the small number of buds per lateral will be as great or greater than that from plants with the longer laterals. The cost of picking will be less and the berries will be of higher grade than from bushes with the greater number of buds to the lateral. Figure 24 shows a field

of purple raspberries trained to the system described above, and Figures 25 and 26 illustrate the method of pruning both black and purple types.

Sometimes the canes of black raspberries are topped at a height of $3\frac{1}{2}$ to 4 feet and a 1-wire trellis or a horizontal trellis with a wire on each side of the row is used to hold the canes erect. In other cases they are not topped but are trained to trellises, as described for training red raspberries. Rarely, however, are the purple varieties trained under any system other than that which includes topping at a height of $2\frac{1}{2}$ to 3 feet and pruning back the laterals in the spring. The expense of such a system is less than where a trellis is used, and under ordinary conditions the maximum amount of fruit of both black and purple raspberries will be secured at a minimum cost.

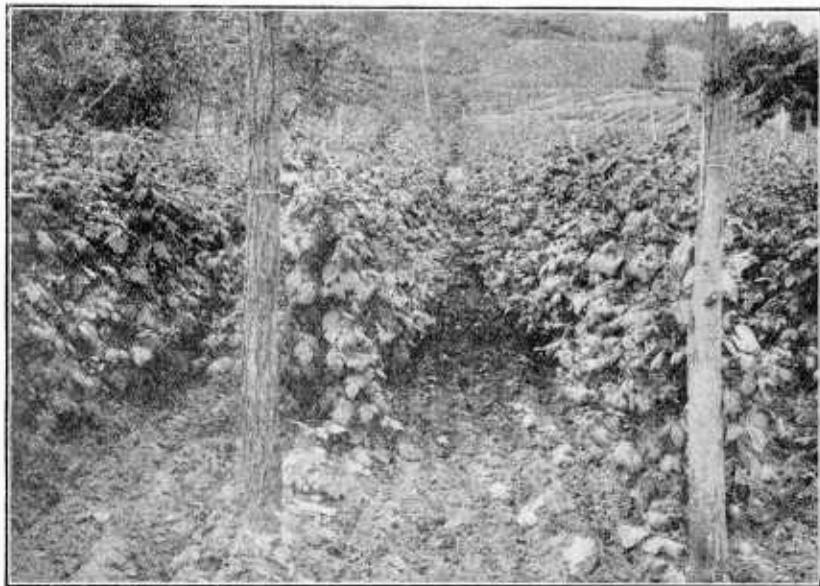


FIG. 20.—A field of 1-year-old Empire red raspberries trained to a single-wire trellis under the linear system. The bearing canes are tied to the wire to hold them erect. (Photographed at Marlboro, N. Y., June 23, 1915)

REMOVING OLD CANES AND THINNING NEW CANES

In nearly all sections, under all systems of training, the fruiting canes should be removed as soon as the crop has been harvested. If this is done the young canes have more room in which to develop and will have more sunlight. Also it is supposed that by the removal and burning of the old canes on which may be insects and diseases the plantation will be kept in a healthier condition.

At the same time that the old canes are cut out the young canes and suckers should be thinned. Where red raspberries are kept in hills, all suckers and all the weak new shoots should be removed. Ordinarily 5 to 7 strong, vigorous canes should be left, but as high as 8 or 9 canes may be safely left in vigorous hills where the plants are set 5 feet apart each way. In the irrigated sections of Colorado, however, it is considered best to leave 8 to 12 canes per hill of the

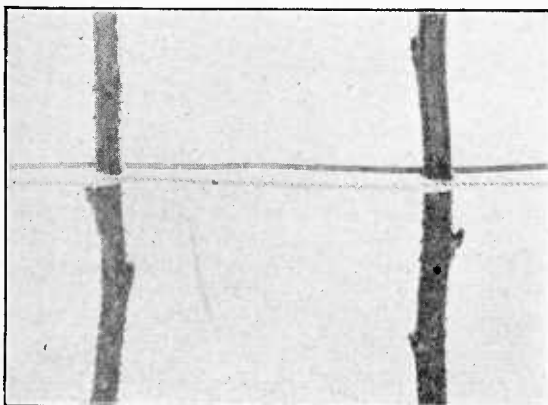


FIG. 21.—Raspberry canes tied to a wire trellis. Canes can be tied very rapidly when this system is used, and the cost per acre is small

Marlboro variety. The Ranere in New Jersey makes a large number of small canes, and as many as 10 or 12 may be left to each hill. Sometimes, in order to secure a large crop on the new canes of the Ranere in late summer, all canes are cut off at the ground in early spring and the strength required to mature an early crop forced into cane production.

Investigations in Michigan indicate that all the strong canes in black and purple raspberry fields should be left to secure maximum crops. Most

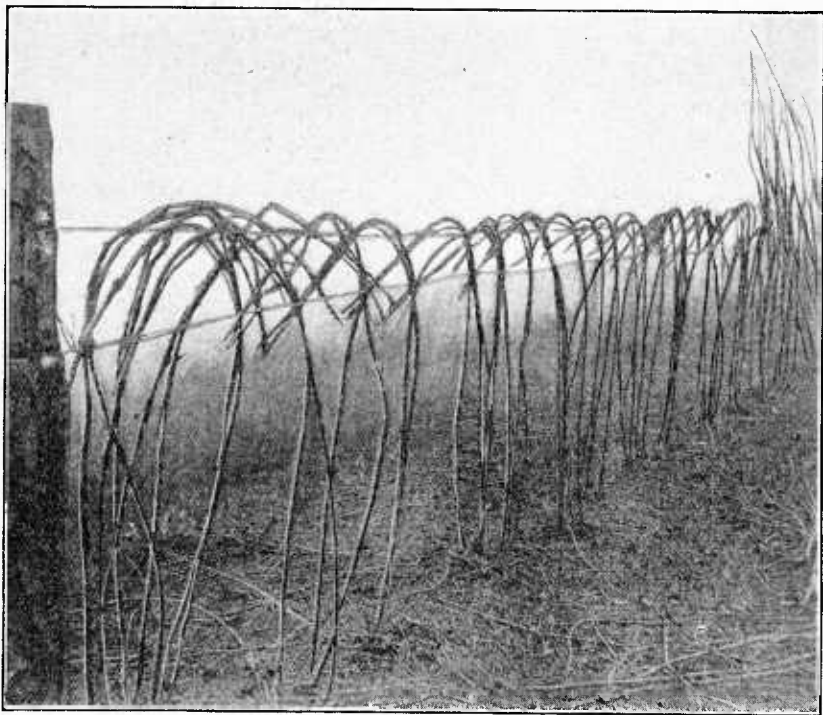


FIG. 22.—Red raspberries planted on the linear system and trained to a wire trellis. The canes are arched over the upper wire, tied to the lower wire, and the projecting ends cut off. (Photographed at Sumner, Wash., February 17, 1915)

plants of black varieties will average four strong canes each. Some strong plants, however, can support five canes, while weak plants may not be capable of carrying more than two canes.

When the hedge system is used the canes should be thinned so that they are not closer together than 8 inches. When several canes appear from the same crown, the more vigorous ones should be left. Figure 17 shows proper thinning under this system. Figures 18, 19, 22, and 23 show fields under the linear system in which the canes have been thinned properly, and Figures 8 and 27 show red raspberries under the hill system where the canes have been thinned correctly.

Different types of cane cutters used for removing the old canes and surplus young ones are shown in Figure 28. When the blade is kept sharp and a quick pull is given, such cutters are very satis-

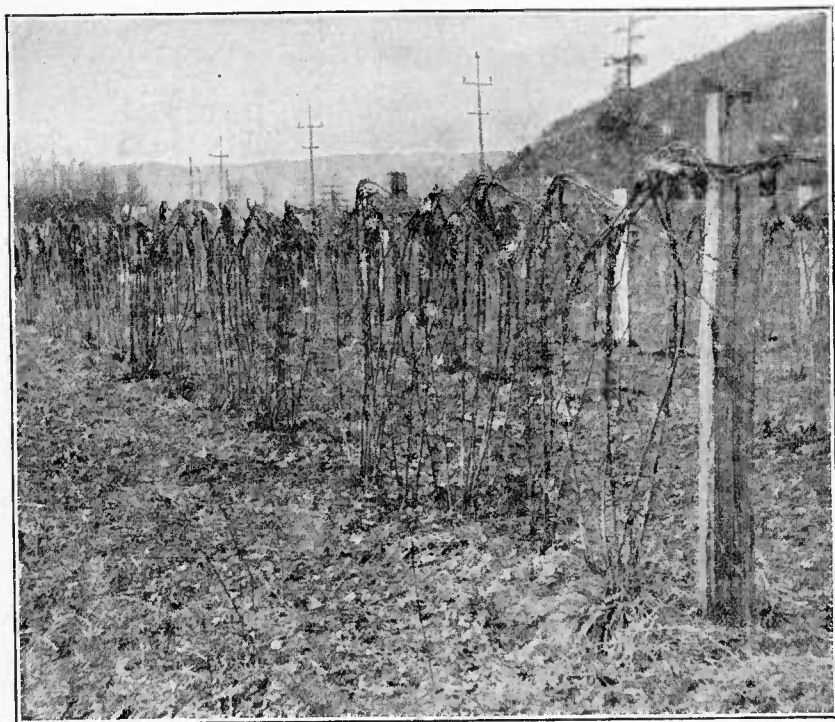


FIG. 23.—Red raspberries planted on the linear system and trained to a wire trellis. The canes are bent over the wire and caught between the canes of the next hill. It is usually better to weave each cane separately than all the canes of a hill together, as is shown here. (Photographed at Sumner, Wash., February 17, 1915)

factory. Pruning shears of various types are often used on small plantations. In New Jersey, where the *Ranere* is grown extensively, hedge shears are used to cut off the ends of the young canes which have fruited, and to prune the canes back to the proper height.

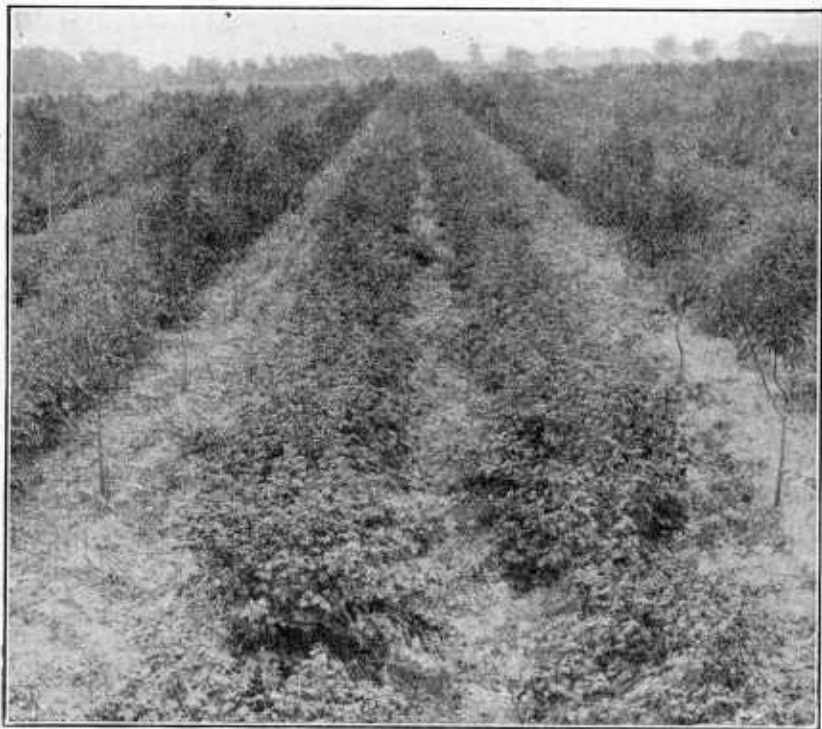
PRUNING FOR LATE FRUIT

In order to extend the season of red raspberries for the home table, the canes should be cut back to within about a foot of the ground in the autumn or in early spring. The strength of the plant then will

go into the lower buds and a long shoot will be made before the flowers appear. The fruiting season may be extended from two to four weeks by this practice, but the crop will be reduced considerably.

WINTER PROTECTION

In many parts of Colorado and in some of the western North-Central States raspberry canes must be protected from the cold drying winds of winter. Usually soil is used for this purpose and is more satisfactory than straw or similar material. The canes are all bent



P 16856 HP

FIG. 24.—Columbian purple raspberries planted in accordance with the linear system. Each plant is made to support its crop of fruit by careful pruning. The canes were topped 2 feet high and the laterals pruned back to 18 or 20 inches. (Photographed at Webster, N. Y., July 15, 1915)

over in the same direction and held down by a clod of earth or a piece of old cane broken half in two. A furrow of earth is then thrown over them with a plow and later smoothed by hand labor so that the canes are entirely covered. The labor required to do this is considerable, and records show that by this method it costs from \$30 to \$40 per acre to cover the canes and to uncover them the following spring.

Another method, used in Idaho, in covering extensive areas of black raspberries, is to draw an implement like the one shown in Figure 29 over the row of canes. The front is high and wide and the back low and narrow. When this is drawn over the bushes, the

canes are left lying along the row close to the ground. Plows, one on each side of the row, are placed so that the plants are covered by the furrows thrown to the center from either side. Furrows 10 to 14 inches wide and not over 4 inches deep should be turned on the bushes. The size of the furrows will depend on the stand of canes.

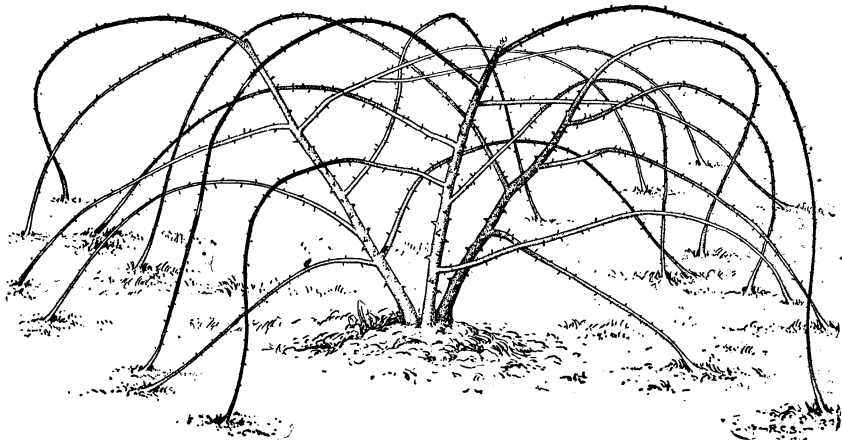


FIG. 25.—A black raspberry plant with the laterals rooting at the tip. (See fig. 26)

This implement with two plows attached can be drawn by two horses and managed by three men. About 10 acres per day can be covered at a cost of approximately \$1.25 per acre. If the implement is well made it will not bruise the canes badly, and it can be constructed at a cost of but a few dollars by any berry grower.

The canes should be uncovered in spring before growth starts and yet not until after danger from severe weather has passed. Sometimes a gradual removal of the soil will be found advantageous. The canes will then become accustomed to the air and light by degrees and there will be less danger of injury to the buds.

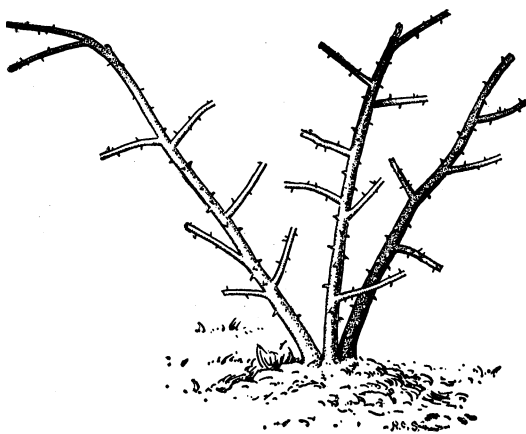
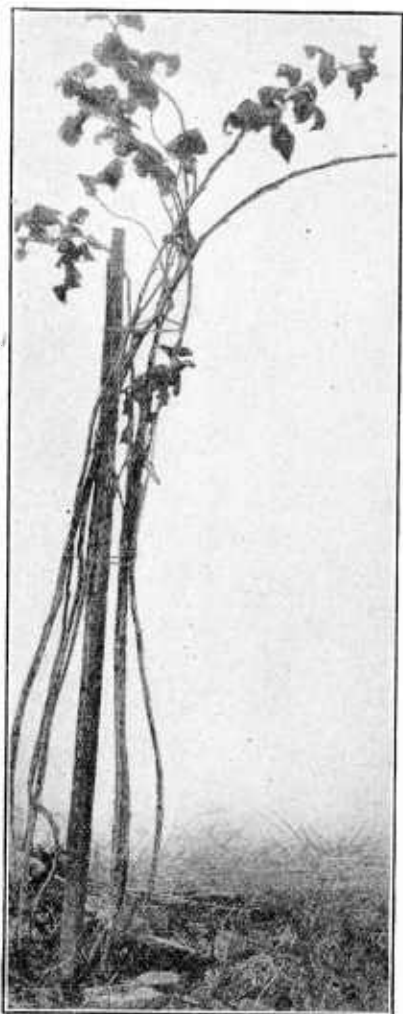


FIG. 26.—The black raspberry plant shown in Figure 25 after it has been pruned, leaving two buds to each lateral branch

DURATION OF A PLANTATION

The factors which determine the number of years a plantation will be profitable are not entirely understood, but to a large extent they depend on the care given it. In the Puyallup Valley of Washington, some red raspberry plantations have been bearing good crops for 15 years and show no signs of becoming less fruitful. In the

eastern United States raspberry fields nearly as old are still in good condition, and small patches are much older. The canes in such fields have been thinned regularly and the moisture supply kept up by constant cultivation and by furnishing a plentiful supply of



P 20452 HP

FIG. 27.—A plant of Perfection red raspberry grown in accordance with the hill system, the canes being trained to stakes. Seven canes have been left for fruiting. (Photographed at Milton, N.Y.)

humus. In the care ordinarily given the average plantation the moisture supply is allowed to become deficient at times, and the new canes do not have an opportunity to develop as they should. Sometimes black and purple varieties are allowed to bear so heavily that they can not send up new canes, and such plants die. Often diseases and insects affect a plantation so that it becomes unprofitable. By systematic pruning, by maintaining the humus supply, and by constant cultivation the life of the plantation should be extended indefinitely. Perhaps the average length of life of a plantation in the Eastern States is 8 to 10 years for red raspberries, and 6 to 8 years for black and purple raspberries.

HARVESTING

Raspberries should be handled as carefully as possible in harvesting, in order to avoid injuring them. The subsequent behavior of the fruit on the market depends in a large measure upon the care used in picking and handling.¹ Berries injured or bruised in handling, or soft from being overripe or from rainy weather, are attacked quickly by certain mold fungi which cause their decay. To avoid as much injury as possible in picking, three fingers always should be used; very few berries should be held in the hand at one time; the berries always should be placed, not dropped,

into the basket or cup; all decaying, overripe, and injured berries should be discarded; and no later handling of the berries in the basket for any purpose should be allowed.

¹ See Ramsey, H. J., Factors governing the successful shipment of red raspberries from the Puyallup Valley. U. S. Dept. Agr. Bul. 274, 37 p., 26 fig. 1915.

Carriers used in picking are shown in Figures 30 and 31. The berries should be picked into baskets carried in the waist carriers. As soon as the baskets are filled they should be transferred to the hand carrier, which always should stand in the shade. Waist carriers suspended from the shoulders, like that shown in Figure 31, are not as likely to spill the berries as are those suspended from the waist.

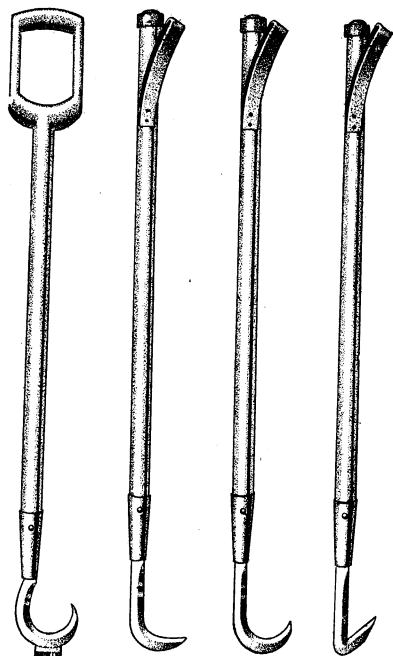
In many sections the waist carrier holds two baskets, one for very ripe fruit and one for firm berries suitable for shipping. The very ripe fruit is used for canning and the firmer fruit for shipping to distant markets. When pickers are trained to use both baskets they lose very little time in the grading. Usually six to eight pickers per acre are needed in harvesting.

In western New York, where black raspberries are grown for drying, the berries in most cases are not picked by hand. Instead, a harvester or "bat" is used, with which a man can harvest from 5 to 8 bushels of berries a day. The "harvester," shown in Figure 32, is placed somewhat under the bush, and the bush is drawn over it by a short wire hook held in the left hand. The ripe berries are then knocked off with a light wooden paddle, like that shown in Figure 33, and fall into the harvester. More than half of the crop is secured the first time the field is gone over. Usually the remainder of the crop can be harvested by going over the field a second time. In some seasons it will be necessary to perform this operation a third time in order to get all of the fruit.

In Idaho, berries of the Gregg variety are allowed to dry on the bushes. The bushes then are cut and bundled. As soon as they are dry, the berries are separated by thrashing. The berries, thus separated, hold the receptacle and have short stems, which are removed by running through a roller machine. This system is adapted only to sections with nearly rainless summers.

YIELDS

Yields from raspberry plantations vary greatly according to the varieties raised, the care given them, and the conditions under which they are grown. In the eastern United States it is agreed



P 20860 HP

FIG. 28.—Homemade raspberry-cane cutters used to cut out the old canes and superfluous new ones. The total length of the cutters is about 34 inches. Straps on the handles of those at the right enable the worker to maintain a firm grip

generally that in sections to which they are adapted the purple sorts are the most productive, the blackcaps next, and the red varieties the least productive. The average yield for the United States is less than 1,000 quarts per acre. No grower, however, should be satisfied with such yields. Records of red-raspberry growers in New York State indicate that the average yield of good fields is between 1,300 and 1,400 quarts per acre, while the best fields go as high as 4,000 quarts. Black raspberries in the same State average between 1,400 and 1,700 quarts per acre, and the purple varieties average between 1,700 and 2,300 quarts.

Yields in different sections as well as from different varieties vary greatly. In the Loveland section of Colorado the Marlboro variety will yield over 4,000 quarts per acre when protected during the winter and when other conditions are favorable. In the Puyallup Valley of Washington, fields of Cuthberts properly cared for will yield 6,000 quarts per acre and the Antwerp 8,000 quarts per acre. Eastern growers who have given their plantations as intensive care as is given in Washington have been getting yields nearly as large as those secured in that State.

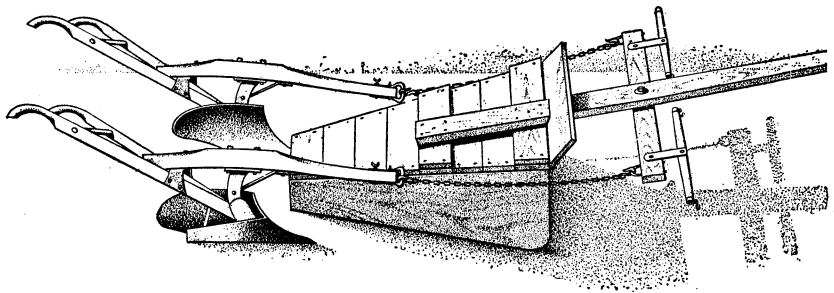


FIG. 29.—Implement used in covering raspberry canes for winter protection. The evener must be made long enough to allow the horses to pass one on each side of the row

DISEASES AND INSECTS

There are several serious diseases of the raspberry which are largely responsible for the decline in the production of this fruit in recent years. These are "virus" or "mosaic" diseases, crown-gall, and anthracnose. At the present time the control of these diseases is the most important factor in raspberry growing. Control of virus diseases and crown-gall is effected through the planting of clean stock, and this is difficult to secure. Anthracnose affects black and purple raspberries chiefly and may be controlled by spraying. Insect enemies of the raspberry are sometimes serious in certain localities but are of far less importance than the diseases mentioned. Information in regard to the control of diseases and insects may be secured by writing to the nearest State agricultural experiment station or to the United States Department of Agriculture at Washington, D. C., and furnishing specimens of the insects and the affected parts.

PROPAGATION

Plants of the different varieties of raspberries may be secured from any reliable nursery, and usually in starting a new plantation this is

done. Many growers having an established plantation propagate their own stock.

To propagate new plants, the tips of the new canes of black raspberries and of the purple varieties now under cultivation should be buried in moist soil in late summer. By the following spring the tips will have rooted and formed good plants. The cane then should be severed, leaving 4 to 8 inches of cane with the new plant which is to be set in the field, as shown in Figure 6. In planting, however, this cane should be buried or cut off, leaving none of it above ground.

If the tips of the canes of black and purple varieties are pinched off when they are about 12 inches high, the canes will branch freely and a large number of tips for burying will be secured. With many growers the first crop from both black and purple raspberry plantations is a crop of plants. In fact, a large part of the plants distributed by nurserymen are produced in this way by raspberry growers, who in turn sell them to nurserymen. As previously stated, the strongest tip plants will make by far the best growth and should be selected for planting.

Red raspberries send up new canes from the base of the old canes, as do black and purple varieties. In addition, they send up suckers from underground roots at various distances from the crown of the parent plant. In starting a new plantation the strongest of these suckers are used. If a quantity of plants for setting is needed each year for several years, it may prove desirable to take up all plants in a given part of the field, both the old ones and the suckers. By the following year a solid stand of plants suitable for setting will have sprung up from the pieces of roots left in the ground. When these are dug and the ground is rich, another stand will grow for the following year. If this practice is followed, the fruiting plantation need not be disturbed by digging up sucker plants. Sometimes growers of the Marlboro and Ruby varieties wait until suckers appear in the spring and set these out. Such plants will be small, but should be very free from insects and diseases.

Raspberries may be propagated also by cuttings of the roots or canes, if necessary. In ordinary practice, however, the cane cuttings are rarely used. Root cuttings are sometimes used in propagating red varieties.



FIG. 30.—Waist and hand carriers. The waist carriers hold two cups or baskets and the hand carriers six

VARIETIES

The varieties of raspberries under cultivation have come from different parts of North America and Europe and are adapted to different conditions of environment and to different uses. Thus the Sunbeam and Ohta originated in South Dakota and generally with-



FIG. 31.—A picking carrier made to hold two oblong pint baskets. This carrier is suspended from the shoulders and is not likely to spill the berries when the picker is bending over

stand the trying conditions of the cold winters there. The Superlative, which originated in Europe, where the winters are milder than in most raspberry-growing sections of this country, is grown only in the Pacific Coast States. The King is a desirable variety throughout the region between the Mississippi River and the Appalachian Mountains, where raspberries succeed. In New York and New England, however, it has proved, for the most part, inferior to many other varieties. The Latham, which was originated by the Minnesota Agricultural Experiment Station, is hardy and one of the most productive varieties in all northern regions.

In selecting the varieties of raspberries to cultivate in any locality it is usually important to consider (1) the

hardiness of the canes, (2) the productiveness of the variety, and (3) its fitness for the particular purpose for which the crop is to be used. In the characterizations here given special attention has been paid to these points. Thus, if in western New York State varieties are desired through a long season, the following may be selected: For red varieties, the June or Ontario for early, the Cuthbert or Latham for late, and the Ranere (*St. Regis*) for its fall crop; for

black varieties, the Farmer and Cumberland; and for purple varieties, the Columbian and Royal. In the Middle West the list should include: For red varieties, the King and Loudon, or perhaps the Ranere and Cuthbert in sheltered places; for black varieties, the Kansas, Farmer, and Cumberland; and for a purple raspberry, the Cardinal. In Oregon and Washington a satisfactory list may include: For red varieties, the King or Marlboro for early, the Cuthbert and Antwerp for late; and the Farmer and Cumberland for blackcaps. In California, generally, the Surprise red raspberry has been considered the best variety, though the Ranere is liked. The season of ripening for these raspberries is given in the characterizations.

These lists for the different sections are suggestive only, as in certain localities the varieties named may not prove equal to others. In the United States as a whole, the Cuthbert is the leading red variety. Growers seem to prefer to plant a single variety rather than several varieties and commonly select the Cuthbert. In New Jersey, however, the Ranere is the variety usually grown; in Minnesota it is the Latham, and in Colorado the Marlboro.

If varieties suited to special uses are desired, the following suggestions will prove helpful:

For jams and preserves, the Cuthbert, Cardinal, Columbian, and Royal are especially desirable.

For canning, the Cuthbert among the reds; the Cardinal, Columbian, or Royal among those of purple color; and the Farmer and Cumberland among blackcaps. Other varieties may be equally desirable for some localities, but the commercial industries are based largely on those named above.

The following are among the most desirable raspberries in cultivation at the present time:

RED AND YELLOW VARIETIES

ANTWERP.—European origin. Berries large, slightly conical, dark red, fairly firm, rather acid; season early, but later than Marlboro. Bush tender, subject



FIG. 32.—Harvesting black raspberries for the evaporator with a harvester or "bat." The canes are drawn over the harvester with a wire hook held in the left hand, and the berries are knocked off with a paddle in the right hand.

to crown-gall; grown only on the Pacific coast, where it is used chiefly as a companion to the Cuthbert; in Washington, at least, it is more productive than the Cuthbert. Not hardy in most other parts of the United States.

CUTHBERT.—New York origin. Berries large, conical, deep, rich crimson, firm; season late. Bush moderately hardy, being tender in Minnesota and other North-Central States, sometimes also in exposed locations in New York and in the region near the Atlantic coast in New Jersey and New England; canes very tall. The principal variety in many sections, and one of the best for canning. Adapted to sandy loam, but will do well on a wide range of soil types.

EATON (Idaho, Iowa¹).—Indiana origin. Berry very large, crumbles badly and does not separate easily from the receptacle in some sections, very acid; midseason, ripening through a long period. Bush hardy with short, stout, erect canes. In New England this has proved to be the most productive of all red raspberries, but because of its poor quality and its tendency to crumble and rot before ripening it is not desirable except for jam and preserves. In the Central States it does not usually make a sufficient number of canes to produce well.

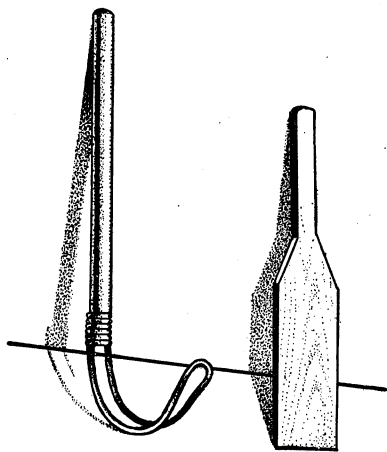
GOLDEN QUEEN.—New Jersey origin. Berries similar to the Cuthbert except in color, which is yellow. Bush very similar to the Cuthbert in all respects. Desirable for home use and for amateurs and adapted to the same conditions as the Cuthbert.

HERBERT.—Canadian origin. Berries large, somewhat conical, bright red, slightly softer than the Cuthbert; midseason, ripening a little earlier than the Cuthbert. Bush usually hardy except in the Central States; prickly, vigorous, with spreading growth. Grown in northern regions where the Cuthbert is not hardy, especially in New England and New York, where it is more productive than the Cuthbert.

JUNE.—New York origin. Berries large, bright red, firm; season very early and long. Bush entirely hardy in the Eastern States, vigorous. Promising new variety for heavy soils in New York and New England, not widely tested elsewhere; sometimes lacking in dessert quality.

KING.—Berries fairly large in sections to which it is adapted, bright red, firm, dropping from bushes when overripe; season early and long. Bush generally hardy, vigorous. One of the

Fig. 33.—Hook and paddle used in harvesting black raspberries in the Dundee section of New York State



best early varieties; has replaced Marlboro in many sections of the Central West and in West Virginia. Not generally desirable in New York and New England. Very productive on clay loams.

LATHAM.—Minnesota origin. Berries large, medium red, firm, season very late, later than Cuthbert. Bush hardy even in eastern North Dakota, vigorous, and very productive. Where this has been tested east of the Rocky Mountains it has proved to be the most productive raspberry. Though not of high dessert quality it should be widely tested. Care should be used to secure stock free from mosaic disease.

MARLBORO.—New York origin. Berries medium to large, bright red, firm; season early and long. Bush hardy, canes short and stout in the East, but must be supported in Colorado and westward. Frequently grown as a companion to the Cuthbert. Principal variety in Colorado. Adapted to sandy loams somewhat heavier than those on which the Cuthbert does best. Susceptible to virus diseases and is being replaced by other sorts.

NEWMAN.—Canadian origin. Berries large, medium red, firm, good dessert quality, midseason, about the season of Cuthbert. Bush hardy, erect, vigorous, and productive. Where tested this has been entirely hardy, very productive,

¹ Another variety is also grown under the name Iowa.

and quite free from mosaic disease. It is a promising new variety for the Northeastern States.

OHTA.—South Dakota origin. Berries large, light red, firm, acid; season early. Bush very hardy, prickly, vigorous. Recently introduced. Not very productive. Considered promising in the northern Great Plains area and in other sections having severe winters, but should be tested further.

PERFECTION.—New York origin. Berries large, bright red, very firm, not very good quality; season early and long. Bush hardier than the Cuthbert. The principal variety in the Hudson River valley and grown somewhat in the New England States. The stock of this is mostly affected by virus diseases and is being replaced.

RANERE (*St. Regis*).—New Jersey origin. Berries small to large, bright red, soft; season very early and long; after the old canes have borne, the young canes begin bearing and in New Jersey bear freely until frost. Bush hardy, sends up suckers so freely that very thorough cultivation is necessary to keep them down; very susceptible to crown-gall. Resistant to virus diseases. Long grown in New Jersey, where usually about five-sixths of the crop is borne in spring and the rest in autumn; should be tested carefully before it is planted heavily in regions where it has not yet been tried, as it will not bear much in the autumn in some regions, and not at all in the autumn in some seasons of drought. Very promising in California.

SUNBEAM.—South Dakota origin. Berries large, bright to dark red, fairly firm, acid; season early. Bush very hardy, prickly, and vigorous, fairly productive. Recently introduced. Considered promising in the northern Great Plains area where other varieties are not hardy; should be tested further. Withstands drought well.

SUPERLATIVE.—European origin. Berry large to very large, conical, soft; a dark unattractive color when ripe and does not separate easily from the receptacle; quality good in California, rather poor in Washington; season medium early. Bush very tender, very vigorous. This is an English variety, the canes of which are not hardy in the eastern United States; it is considered desirable only in California near San Francisco.

SURPRISE (*California Surprise*).—California (?) origin. Berries medium size, conical, firm, good quality; season early, will bear a good second crop in California the first and second years after setting, but a smaller second crop thereafter; will bear some fruit in southern California almost every month in the year. Bush hardy in California, but hardness unknown elsewhere; canes slender. The most desirable variety at the present time for central and southern California.

PURPLE VARIETIES

CARDINAL.—Kansas origin. Berries very large, rather soft, but firmer than fruit of the Columbian. Bush very hardy; hardier than Columbian, Haymaker, or Shaffer in the Central West; very productive. Can be grown farther south than most raspberries.

COLUMBIAN.—New York origin. Berries very large, rather soft; season late, about with Cuthbert. Bush usually hardy in the East, but not always hardy in the Middle West; very vigorous, very productive. One of the best canning raspberries and grown more extensively than any other purple variety.

ROYAL (*Royal Purple*).—Indiana origin. Berries large, firm; season very late and long, ripening most of its crop two weeks later than Columbian, maturing with the early blackberries. Bush hardy where tested in New York and New England; very productive; canes reddish and nearly smooth. One of the best canning and preserving raspberries. Promising for general culture, but should be tested before it is planted extensively.

BLACK VARIETIES

CUMBERLAND.—Pennsylvania origin. Berries very large, firm; midseason. Bush usually hardy. Is more widely planted than any other black raspberry because of its productiveness and quality; frequently planted with the Farmer.

FARMER (*Plum Farmer*).—Ohio origin. Berries very large, firm; season early and short; ripening so quickly that the entire crop can be harvested in two

or three pickings. Bush hardier than most blackcaps; withstands drought well. Very promising, especially for planting with the Cumberland and for use in sections where black raspberries are grown for evaporating.

GREGG.—Indiana origin. Berries large, firm; midseason. Bush usually hardy and productive. Extensively grown, but being superseded by others in some sections.

HOOSIER.—Indiana origin. Berries generally reported small, although large and firm at Pekin, where it originated, and in Missouri; quality excellent; ripens with Cumberland. Bush at Pekin, Ind., hardy and productive.

KANSAS.—Kansas origin. Berries large, firm; season early. Bush somewhat tender. Grown in Michigan with the Cumberland; in some sections is being replaced by Farmer.

OLDER.—Iowa origin. Berries large, rather soft. Bush vigorous, of a somewhat trailing nature, very hardy for a black variety. Desirable for Iowa and Minnesota conditions.

PEARL (*Black Pearl*).—Missouri origin. Berries large, firm; season early and short. Bush hardy. Grown extensively in Kansas, Missouri, and Michigan but not widely tested elsewhere. Especially desirable as a companion to the Cumberland or Gregg in the above-named States. Very promising at the Maryland Agricultural Experiment Station.

AUTUMN-FRUITING VARIETIES

Certain varieties of red raspberries will fruit on the young canes in late summer. The best known variety having this characteristic is the Ranere (*St. Regis*), which is grown extensively in New Jersey and is the leading variety also in Maryland and Virginia. Other varieties in the trade are the Erskine, which often has crumbly or imperfectly developed fruit, and La France. The latter variety is a European sort and not hardy except on the Pacific coast. Both Ranere and La France are proving of value in California. During seasons with rainy summers or under irrigation these varieties will produce considerable fruit in the late summer and autumn months, but when the moisture is deficient they can not develop good fruit. Growers in New Jersey frequently market large quantities of fruit in August and September, and under conditions similar to those in New Jersey autumn-fruited varieties are likely to prove desirable.

HYBRIDS AND RELATED FORMS

At present there are in the trade in this country no hybrids between the common forms of raspberry and other species of *Rubus* known to be valuable for their fruit, nor are there hybrids between the raspberry and other fruits. The Van Fleet, a recent hybrid between the Cuthbert and a Chinese raspberry species,¹ shows valuable characteristics for the Southeastern States, especially for the heavier soils from Maryland to Georgia and Alabama.

Several forms related to the raspberry are being propagated by the trade. Of these the form² sometimes called the Golden Evergreen raspberry or Himalayan Golden raspberry comes from India and southern China and will thrive only in the subtropical climates of southern California and southern Florida. The bush is perennial, and will grow to a height of 15 to 20 feet, with a spread of 30 feet in a few years. Usually it does not begin to bear until it is from 3 to 5 years old and then may sometimes bear

¹ *Rubus innominatus*.

² *Rubus ellipticus*.

annually more than 100 quarts per plant of golden-colored fruit which is about the size of a small black raspberry. The fruit is of only fair quality, but is of some value for home use in regions where other berries will not grow. Other forms widely advertised at times are the Wineberry,³ which is a native of Japan and China, bearing cherry-red insipid fruit, the Strawberry-Raspberry,⁴ a native of Japan, bearing scarlet fruit of poor quality, and the Chinese Raspberry,⁵ a native of China, bearing a small quantity of sweet yellow fruit. None of these forms has proved to be of commercial value.

USES

A large part of the raspberry crop is marketed in the fresh state, to be used in the home for various culinary purposes. In addition, large quantities are canned with or without sugar. The Census Bureau reports that the value of the canned product in 1914 amounted to \$1,137,207, of which 48 per cent was packed in New York State, 22 per cent in Washington, 16 per cent in Michigan, 7 per cent in Oregon, 2 per cent in Maryland, 2 per cent in Ohio, and 3 per cent in other States. Fruit thus canned is used largely for cooking and domestic consumption. It is used also by pie manufacturers and by those who make soda-fountain sirups, crushed fruits, and flavoring extracts.

The standard-size can for packing raspberries for the general trade is the No. 2, which should contain at least 1 pound 3 ounces when packed in water without sugar sirup. Large quantities also are packed in No. 10 cans and in barrels.

Raspberries are made also into jams, jellies, and preserves and quantities are used for making essences and extracts. The juice is sometimes expressed and sold for use as a beverage, and it is used also in the making of ice creams and sherbets.

Red and purple varieties are not often dried or evaporated, but large quantities of black raspberries are marketed in this form. Such dried fruit is used by pie establishments and also by housekeepers in sections of the West where raspberries are not grown.

Brief directions for utilizing raspberries follow. For detailed information, see United States Department of Agriculture Bulletin 196, "Methods Followed in the Commercial Canning of Foods," and United States Department of Agriculture Miscellaneous Circular 24, "Time-Tables for Home Canning of Fruits and Vegetables."

Canning in tins.—Only cans that have been lacquered on the inside should be used for raspberries. Stems, leaves, and defective fruit should be discarded and the cans then filled with a certain weight of berries. Hot water or hot sugar sirup should be added, the can exhausted, the top inserted and sealed, and the whole can sterilized. The sterilizing process takes 12 minutes at 212° F. If a sirup is added it should be of the right degree of density to bring out the flavor of the particular variety. Usually the density will range from 15° to 50°. A 50° sirup is made by adding 8 pounds 6 ounces of sugar to 1 gallon of water, and a 15° sirup is made by adding 1 pound 7½ ounces to each gallon of water.

³ *Rubus pheonicolastus*.

⁴ *Rubus illecebrosus*.

⁵ *Rubus xanthocarpus*.

Canning in glass jars.—If there is no objection to shrinkage, the berries may be put in the jars, covered with a hot sirup of 15° to 50° density, and then sterilized for 20 minutes at 212° F. The covers should be fastened on immediately after cooking. If jars full of fruit are desired, the berries should be cooked before being packed in the jars and less sirup used.

Making jam.—For making jam the fresh berries may be used when thoroughly mashed or they may be left whole. If they are used without mashing, some water must be added before cooking, and the cooking will take longer than if no water is added. Ordinarily sugar equal in weight to the berries should be added before cooking. If the fruit is very acid more sugar should be used; if the berries are mildly acid less sugar will be needed. The jam should be cooked at 212° F. for 20 minutes or until it is the desired thickness and then placed in jars and sealed.